

Georeferencing and Digitization of Walkways: A GIS Case Study

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Abstract :- Last couple of decades has witnessed increasing availability of information on the internet. With the advent of location based services, need for digitized spatial content has gone up. This case study is focusing on digitization process of walk ways in a campus. Also to digitize trees along these walkways and to do the analysis to know about the area covered by shed of trees during various months of the year is accomplished. The whole case study consists of details about collection, Georeferencing and analysis of spatial data.

Keywords: Georeferencing, digitization, view shed, GIS

1. INTRODUCTION

In many technological applications (like Google Earth and Google maps), prevalent currently, there is a need to manage geometric, geographic, or spatial data, which means data related to space or geometric data. Characteristic for the technology; emerging to fulfill needs of these types of applications is the capability to deal with voluminous geometric data, for example, a set of 100000 polygons.

Spatial databases are designed to make spatial data management easier and more natural to users of location-enabled applications and geographic information system (GIS) applications. These are used to store and query data related to objects in space, including points, lines and polygons. Examples of Spatial data are Census Data, NASA satellites imagery, Weather and Climate Data, Rivers, Farms, ecological impact, Medical Imaging etc. A Spatial Database Management System (SDBMS) can be characterized as a software module that can work with an underlying database management system, for example, an Object-Relational database management system, or Object-oriented database management system. SDBMSs support multiple spatial data models, spatial indexing, efficient algorithms for spatial operations, and spatial query optimization[7].

To ensure the availability of real world spatial data one way is digitization of data collected. Digitizing in GIS is the process of converting geographic data either from a hardcopy or a scanned image into vector data by tracing the features. During the digitizing process, features from the traced map or image are captured as coordinates in either point, line, or polygon format. With reference to the spatial information digitization can the process of creating a vector creating a vector digital database by creating point, line and polygon objects.

There is a great deal of geographic data available in formats that can not be immediately integrated with other GIS data. In order to use these types of data in GIS it is necessary to align it with existing geographically referenced data, this process is also called georeferencing. Georeferencing is also a necessary step in the digitizing process. Digitizing in GIS is the process of “tracing”, in a geographically correct way, information from images/maps. Digitizing is the process of converting analog information into a digital representation. Major tool used in this case study is ArcGIS. Esri's ArcGIS is a geographic information system (GIS) for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database[3]. The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web. ArcGIS includes ArcReader, ArcGIS (desktop version) and several other extensions/plugins.

2. PROBLEM STATEMENT

Primary goal of this case study is digitization of the Walkways of a campus. Also to digitize and analyze the coverage of shed of various trees present on those walkways is covered. Digitizing is the process of making features we can see on the image editable and making them features to which additional spatial and non-spatial attributes can be assigned. This means we are going to follow a process of making digital versions of objects that will have an attribute table associated with them. These walkways and trees after digitization have an associated attribute table and will be represented as point object. The data classes and attributes for each feature were selected carefully to ensure that the collected data is easy to process and analyze. Further requisite is to know about the area covered by shed of trees during various months of the year.

3. METHODOLOGY

The case study under consideration consists of many stages which are data collection, data assimilation in GIS format, data analysis of tree shades. Under the data collection phase location of all the walkways and trees in that area is taken.

Data assimilation is about Georeferencing and digitizing the collected data. Further analysis of shade coverage of trees is done.

3.1 Digitizing walkways

The digitizing process is done by creating layers in ArcCatalog, and then adding features to them in ArcMap. The walkways were digitized using GPS in the Nokia E71 phone. The phone was used to collect pedestrian path data through ‘geo tagged’ images. A total of 1562 images were recorded and located on the given map. The attribute table of these images has been populated. The main attributes are

Wid: unique identification of a particular walkway.

Width (in meters)

Continuity : continuous or blocked

Quality :good/ok/bad

Paving type : concrete/unpaved/tile etc

Paving type : concrete/unpaved/other
Latitude and longitude (location)

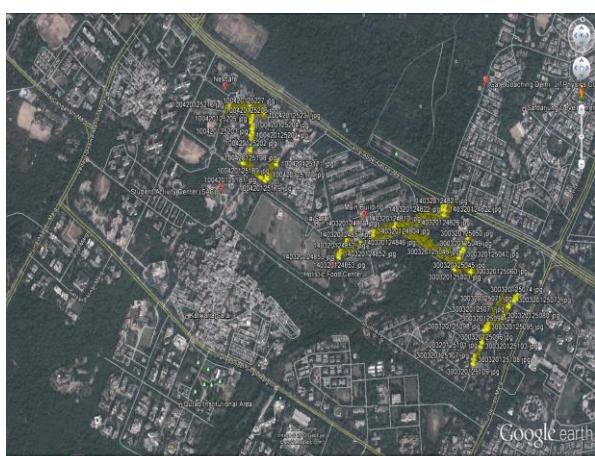


Fig.1 : Location of some of some the geotagged images

Locr software was used to locate the geotagged images on Google Earth so as they could be used as reference for digitizing the pedestrian infrastructure. Existing/available shape files of were used as a reference to cross check location of geo tagged images and to improve accuracy of digitization. The shape files were converted to CAD files using Arcv2CAD 5.0 software. These walkways were constructed as polygons and were classified using attributes. The attributes used were, width, continuity, surface quality and surfacing material. The final drafted polygons for walkways numbered more than 1560 and they were loaded in ArcGIS using Arc catalog and subsequently saved as shape files, by assigning them the same co-ordinate system as the existing/available shape files of the campus.

3.2 Digitizing Trees

For digitization of trees few other devices are also used, one of them is the GPS of Nokia smart phone. For this task different areas have been covered and each and location of every tree is recorded using GPS of smart phone. Also

canopy radii and height of trees are recorded by estimation. Canopy radii and height of the tree are recorded for analysis of shed. These two attributes are added in the attribute table of trees. Various attributes of the table containing data about trees are : id (for identification), canopy radii (in feet, radii of the top of the vegetation above the ground surface) , height (in feet) latitude, longitude and elevation.

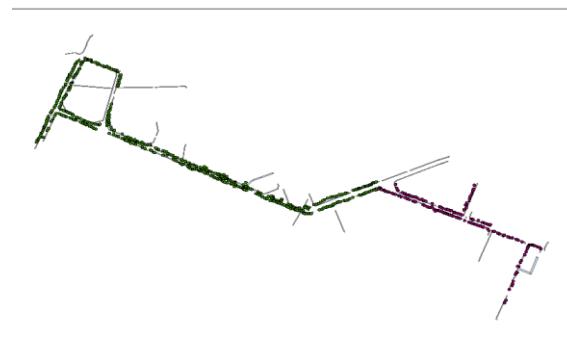


Fig 2. Image of Walkways

3.3 Data Import/Assimilation

After collecting the location and other data of footpaths and trees, the entire trees (points) are plotted on the base image (of campus) taken from Google earth along with the poly lines of digitized footpaths. Proper georeferencing is required at this point in project so as to avoid any location inaccuracy. Also some data editing is done in order to take care of the inaccuracy of the GPS present in the mobile phones.

3.4 View shed analysis

A viewshed is an area that is visible from a specific location. It identifies the cells in an input raster that can be seen from one or more observation locations. Each cell in the output raster receives a value that indicates how many observer points can be seen from each location. Each cell that can see that observer point is given a value of 1. All cells that cannot see the observer point are given a value of 0. The observer points feature class can contain points or lines. The nodes and vertices of lines will be used as observation points.

The viewshed analysis tools are useful to judge the visibility of an object—for example, from which locations on the landscape will the water towers be visible if they are placed in a particular location, or what will the view be from a road? This utility is used to determine shed of trees. Here viewshed is used for determining area covered by shed of trees during various seasons.

4. RESULTS

Properly Georeferenced shape files of walkways and trees along with them are the end product of the case study. Determination of area covered by shed of tree during various seasons is also done as the analysis part of the study.

5. CONCLUSIONS

There is a growing trend towards digitization of historically and culturally significant data. One way to do this is Georeferencing. It involves assigning real-world coordinates to a number of reference points on the image. Collecting data in the field sets the stage for good georeferencing procedures. In this case study walkways in a campus and trees along them are digitized and viewshed analysis of sheds of trees is done.

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